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FINAL REPORT TO THE MASSACHUSETTS HIGHER EDUCATION FACILITIES COMMISSION, APRIL, 1971

EDUCATIONAL MANAGEMENT ASSOCIATES, CAMBRIDGE, MASS.

A STUDY OF SPACE UTILIZATION IN HIGHER EDUCATION FACILITIES IN MASSACHUSETTS

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FACILITIES INVENTORY PROJECT

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Introduction

This paper is intended as a guide to the second stage of a two part study of Massachusetts higher education. The first part, An Inventory and Analysis of Higher Education Facilities in the Commonwealth of Massachusetts, concentrated on parameters of supply: building size, function, age, and cost; this second part, the Space Utilization Study, explores such parameters of demand as enrollment, time of classroom use, classroom occupancy, and space alloted per student. Though both are useful independently, each adds greatly to the value of the other. The facilities inventory provides necessary quantitative and qualitative knowledge of physical resources for drawing implications from patterns of resource utilization. Discerning these patterns of utilization against the background of the facilities inventory should facilitate an understanding of how well and to what extent current demands are being met, while simultaneously aiding in the reallocation of resources to meet future demands.

A major strength of the project lies in the large scale and standard form of its analysis. This removes some of the uncertainty encountered in solving problems of planning, funding, and administering

higher education by providing reliable data for studies and comparisons on a large scale. Because the categories used in this project are compatible with those used in most other federally funded studies of higher education, this study can easily be used with studies from other states. In our analysis we have sought to organize the information to facilitate an easy application to specific studies rather than attempt a more extensive analysis that would have been of questionable value in many applications.

The most important element in the application of the study lies with those who use it. The data stands isolated from important contextual detail, and its value depends on the analyst's ability to place it in context. At this point the planner replaces the computer; his experience and ability to formulate questions counteracts the biases inherent in abstract information. We hope the organization of the project facilitates this effort.

The study was funded through the Higher Education Facilities Act of 1963. This act of the National Congress was the first major entrance of the federal government into higher education, and was marked by an emphasis on planning and goal definition. For this purpose, the Massachusetts Facilities Inventory Project and its

counterparts in other states were initiated. The first facilities inventory was nearing completion when the Space Utilization Study was begun in late 1969, and in January of 1970 the Space Utilization Study data compilation manual and forms were sent to the ninety seven participating schools. There were two forms, one for the Space Utilization Study of classrooms and the second for the library study that was carried out with it. The data for the study was compiled by the schools for a typical week of the fall semester of 1970. It was gathered, coded, edited, and analyzed by the Educational Management Associates in Cambridge, Massachusetts. Individual school reports were sent out March 4, 1971, and the other matrixes are being presented with this paper.

Abstract

The remarks in this abstract are not intended as a summary of the Space Utilization Study; the data contains more inferences than we can draw here. Instead, this is a summary of some of the more interesting and important facts of the project.

In comparing public and private institutions, it appears that:

1. private institutions together have the bulk of the Massachusetts college enrollment (64.7%),
2. individual public institutions have more classrooms than their private counterparts,
3. these public classrooms are designed for a smaller number of students per class,
4. each student in a public institution classroom has more space than his counterpart in a private institution,
5. excepting four year colleges without graduate students, public schools use their classrooms more intensely than private ones.

In comparing all different types of institutions, we find:

1. Universities account for the largest part of the state enrollment (53.2%), followed by four year colleges with graduate students (22.2%), junior colleges (15%), four year colleges without graduate students (8%), and other institutions (1.7%).

2. Non-laboratory classrooms are largest in the public four year colleges with graduate students, followed by the private universities, the public universities, the private four year colleges without graduate students, the private four year colleges with graduate students, the private junior colleges, the public junior colleges, and the public four year colleges without graduate students. In general, the university non-laboratory classrooms are largest, followed by the four year colleges, and then the junior colleges. The public four year colleges are an anomaly in this respect, having much smaller non-laboratory classrooms than their private counterparts (36% smaller).

3. The four year colleges with graduate students make significantly less use of their classrooms than the other institutions. The most efficient utilization of study stations is in the junior colleges and the four year colleges without graduate students.

4. The universities allot less space per non-laboratory classroom station than the other institutions.

5. The laboratories in the private junior colleges are designed to accommodate many more students than is found in the other institutions (22% more students than the average).

The most apparent feature of the library report is the poverty in numbers and variety of the public institutions' libraries compared to the private ones:

1. Private institutions have far more volumes per student.

2. Far more of the specialized libraries (types 2-15) are found at private institutions. While both public and private institutions have an average of about one general library per college, the public colleges average only .7 specialized libraries compared to the private colleges' 2.0 specialized libraries per college.

3. Public colleges have less studying space per student than private colleges.

In comparing the different types of institutions, we find:

1. For both public and private institutions, the four year colleges rank first in the number of volumes per student, followed by the universities, the four year colleges without graduate students, and the two year colleges.

2. Most of the specialized libraries are found at the university level, followed by the four year colleges, the four year colleges without graduate students, and the two year colleges.

3. The four year schools without graduate students have the most studying space in their libraries, followed by the four year colleges, the universities, and then the junior colleges.

In comparing the general (type 1) libraries and the other specialized libraries (types 2-15), we find only one significant difference: the general libraries require more employees per volume than do the specialized libraries.

Outline of the Classroom Report

The Space Utilization Study Classroom Report comprises two parts: a school by school presentation of the data and a state wide summary which largely parallels the first part. Each part is arranged in order of increasing generality, as outlined below.

I. School by School Reports

A. (volumes I - III) Each matrix in this first, most detailed set of matrixes corresponds to a single level of instruction in a single type of classroom for each department at a particular school. The order of the matrixes is as follows:

1. Department name

a. Classroom type 1

(1) Level of instruction 1: derived data

(2) Level of instruction 2: derived data

(3) Level of instruction 3: derived data

(4) Level of instruction 4: derived data

b. Classroom type 2

(1) Level of instruction 1: derived data

(2) Level of instruction 2: derived data

(3) Level of instruction 3: derived data

(4) Level of instruction 4: derived data

c. Classroom type 4

(1) Level of instruction 1: derived data

(2) Level of instruction 2: derived data

(3) Level of instruction 3: derived data

(4) Level of instruction 4: derived data

2. Department name

.
.
.

as above for each department in the institution

B. (volume IV) This set of matrixes is identical in form to the preceding set except the departments are replaced by the less specific general departments.

1. General department name

a. Classroom type 1

(1) Level of instruction 1: derived data

.
.
.

C. (volume V) This set of matrixes gives data for each level of instruction in each classroom type.

1. Classroom type 1

.
.
.

2. Classroom type 2

.
.
.

3. Classroom type 4

.
.
.

D. (volume V) These matrixes are for each classroom type only.

1. Classroom type 1: derived data
2. Classroom type 2: derived data
3. Classroom type 4: derived data

E. (volume V) These matrixes are organized by levels of instruction only.

1. Level of instruction 1: derived data
2. Level of instruction 2: derived data
3. Level of instruction 3: derived data
4. Level of instruction 4: derived data

F. (volume V) This is a summary of the data for each school without regard to any category.

G. (volume V) This last set of matrixes shows the classroom occupancy against the time of the week for classroom types one and two.

II. State totals (volume VI)

A. This set of matrixes is identical with the second set of school by school matrixes (I-B) except it is a composite of all the schools.

1. General department name

a. Classroom type 1

(1) Level of instruction 1: derived data

.
.
.

B. This set of matrixes gives data for each general department.

1. General Department: derived data

.
.
.

C. This set of matrixes gives data for each classroom type.

    1. Classroom type 1: derived data
    2. Classroom type 2: derived data
    3. Classroom type 4: derived data

D. These matrixes give data for each level of instruction.

    1. Level of instruction 1: derived data
    2. Level of instruction 2: derived data
    3. Level of instruction 3: derived data
    4. Level of instruction 4: derived data

E. This set of matrixes gives derived data for classroom types one and two. Each matrix gives the data for different types of institutions.

    1. Classroom type 1: derived data
    2. Classroom type 2: derived data

F. These matrixes give data comparing public and private schools for each classroom type.

    1. Classroom type 1: derived data
    2. Classroom type 2: derived data

G. This matrix summarizes the data for all categories and schools.

H. This last set of matrixes duplicates the matrixes of I-G for the entire state instead of each school, giving the classroom occupancy for each hour of the week for each classroom type.

1. Classroom type 1: derived data
2. Classroom type 2: derived data

The categories of department, general department, classroom type, level of instruction, and time period are defined as follows:

Department and Division or General Department

We have used a standard set of department names and definitions. These departments are grouped into general departments or divisions, which are also referred to in the data matrixes. These codes can be found in the appendix.

Classroom Type (CRT)

All the classrooms were originally divided into four types, but this was later reduced to three. As a result, there are classroom types one, two, and four, but not three. These codes can be found in the appendix.

Level of Instruction (LOI)

This refers to the relative proportion of undergraduates and graduate students in the class.

Level 1:

Composed predominantly of undergraduates (about 2/3 or more undergraduates)

Level 2:

Composed of significant numbers of both graduates and undergraduates (1/3 to 2/3 undergraduates)

Level 3:

Composed predominantly of graduates (about 2/3 or more graduates)

Level 4:

Courses considered supplemental to the regular college program, such as those within programs of continuing and adult education, extension college, or community orientation

Time Period

In some of the matrixes, time periods such as 2:00-3:00 are used. These represent scheduling information rounded off to the nearest hour. In the analysis from which these figures were derived, 1/2 hour periods were used, and class periods less than fifteen minutes in length were counted as zero.

In the first, most detailed school report, each matrix of data corresponds to a particular combination of each level of instruction, classroom type, department, and school. The second set of matrixes resembles the first but replaces the department with the less specific general department. The third set refers to the classroom type and level of instruction; the fourth, CRT alone; the fifth, LOI; and the sixth is a summary for the entire school. These first six follow a common form, giving a central set of derived data for each matrix.

derived data:

rooms used per week

average number of stations per room

average assignable area per room

weekly room hours

weekly student hours

average number of students per class

average station occupancy

average area per station

rooms used per week:

How many different locations used on the school during one normal week match the matrix specifications (department, CRT,

LOI)? This measures the supply of rooms within the limits of the matrix. It includes rooms that the school might consider ideal for this use as well as ones that are barely sufficient.

average number of stations per room:

In the rooms used within matrix specifications, what are the average number of stations (desks, lab positions, listening booths, auditorium seats)? How large a group was the room designed to accommodate?

average assignable area per room:

How much area in the room can actually be used, excluding aisle space and the area taken by service equipment?

weekly room hours:

This is the sum of the amount of time each location is used in a way corresponding to the matrix specifications. It is important in two different ways: it measures the demand made on the rooms and also the size of the statistical sample. The larger this number is, the more likely it is that the data for the matrix reflects what can be called "normal" rather than unusual usage. So this figure is

both a gauge of the value of the other measurements as well as a measurement of demand.

weekly student hours:

This is a measurement of demand, found by summing the products of the number of students in and the duration of each class. It also refers solely to use within the limits of the matrix description.

average number of students per class:

This is the quotient of the two preceding figures. It is not so much a measurement of efficiency as an indication of the method of instruction. Of course, this method of instruction is affected by the demands of the educational system.

average station occupancy:

When a room specified by the matrix is in use, what percent of the room capacity is utilized? This figure can be used as a measure of space utilization efficiency.

average area per station:

What is the size of the average station in this matrix? This is also a measurement of the efficiency of space utilization, but both this and the preceding measurement of efficiency, average station occupancy, have some limitations which will be discussed later.

In addition to the above listed data, the school reports by CRT and LOI have two additional figures:

total number of stations:

This is the sum of all the stations in the locations described by the matrix.

total assignable area:

This is the sum of the assignable areas of all the locations described by the matrix.

The school summaries give a final additional set of data:

full time graduate enrollment

full time undergraduate enrollment

part time graduate enrollment

part time undergraduate enrollment

These figures were provided by the schools and are included here to facilitate comparisons between schools.

Full Time Equivalent enrollment (FTE):

This combines the four previous enrollment figures. It is defined as: full time equivalent enrollment = full time graduate enrollment + full time undergraduate enrollment + 1/3 (part time graduate enrollment + part time undergraduate enrollment).

undergraduate WSH/undergraduate FTE (undergraduate weekly student hours per undergraduate full time equivalent enrollment):

This figure shows the average amount of time spent in class by an undergraduate in one normal week. Like the average number of students per class, this reflects the structure of the teaching process as much as the supply and demand for facilities.

The last section of the school report, the Hour by Hour Utilization of Rooms, gives a clear view of the variation of room use with time and has clear efficiency implications. It does not list the derived data but rather the number of rooms in use and the number and percentage of

stations occupied each hour of the week. This report is given for classroom types one and two.

The first four sets of state totals reflect the first six sections of the school report in the categories used and derived data given; they are averages of the figures given in the school reports. The first section of the state totals gives the derived data by general department, CRT, and LOI; the second, third, and fourth by general department, CRT, and LOI, respectively. The derived data given in each matrix is the same with the addition of three more figures:

$$\frac{\text{number of schools with this department}}{}$$

$$\frac{\text{number of schools with this CRT}}{}$$

$$\frac{\text{number of schools with this LOI}}{}$$

This data, besides being useful in studying the distribution of these categories in Massachusetts, also indicates the size and reliability of the matrix as a statistical sampling. The larger the number, the less likely it is that the figures reflect or are strongly affected by a small number of unusual departments, CRT's, or LOI's on particular campuses.

The state total summary by college type and CRT is very useful in comparing space utilization in different types of institutions. Classification by college type makes two distinctions: first, between junior colleges, four year colleges without graduate students, four year colleges with graduate students, and universities; and, second, between public and private institutions.

The state total summary gives averages of the previously listed data for the entire Commonwealth; it also gives state total enrollments.

The last state total report concerns the hour by hour utilization of rooms and is given for classroom types one and two. This report is a weighted average of the school hourly utilization reports. It and the other state totals provide a good basis of comparison for the school reports, besides providing independently useful information.

Outline of the Library Report

The library report, like the preceding classroom report, begins with school by school reports. Data for each library building in the school is presented in reports grouped by library type, followed by a summary of statistics given for the entire school.

The state totals follow a similar form, with statewide summaries given for each library type, for the more general categories of general libraries and other (specialized) libraries, and a set of grand totals. A final set of matrixes examines library data for different types of institutions: as public or private, and as two year colleges, four year colleges with graduate students, four year colleges without graduate students, universities, and other institutions. The libraries are classified in fifteen different groups:

1. General
2. Life Sciences
3. Math, Computer, Physical, Chemical & Engineering Sciences
4. Psychology
5. Social Sciences
6. Humanities
7. Medicine or Health
8. Law
9. Theology
10. Education
11. Business
12. Social Work

13. Environmental Design
14. Other Degree Professional Schools
15. Other

School Reports

For each school the data is organized as follows:

1. Library Type 1

    a. library name
    b. building number corresponding to the facilities inventory
    c. number of equivalent volumes
    d. study area
    e. stack area
    f. open stack reading area
    g. process area
    h. study facilities service area
    i. number of stations
    j. number of full time equivalent personnel
    k. derived data
        1) (open stack reading area + study area)/number of stations
        2) stack area/volumes
        3) stack + open stack area/volume
        4) number of stations/student
        5) full time equivalent personnel/student
        6) full time equivalent personnel/1000 volumes
        7) (processing + facilities area)/volume
        8) (processing + facilities area)/(study + stack + open stack area)

2.-15. Library Types 2 - 15

same format as Type 1

.
.
.

16. General Library Totals

same format as Type 1

17. Other Library Totals

same format as Type 1

18. Total School Libraries

same format as Type 1

State Total Report

The statewide data is organized as follows:

1.-15. Library Types 1 - 15

same format as in school totals with the addition of the "total number of libraries of this type"

16. General Library Totals

same format as Types 1 - 15

17. Other Library Totals

same format as Types 1 - 15

18. Grand Totals

same format as Types 1 - 15

The state figures outlined above are totals; the next set of figures are averages.

19. State totals by type of institution: The following information is presented separately for public and private two year colleges, four year colleges with graduate students, four year colleges without graduate students, universities, and other institutions.

    a. number of schools
    b. number of libraries
        1) general
        2) other
        3) total
    c. average enrollment
    d. average number of libraries
        1) general
        2) other
    e. average number of stations per student
        1) general
        2) other
    f. average number of volumes per student
        1) general
        2) other
    g. average number of volumes per school
        1) general
        2) other
    h. total volumes
        1) general
        2) other

20. The same data with the same format as the preceding matrix is presented separately for public and private institutions.

21. The same data with the same format is given as a statewide aggregate.

The data given is derived or defined as follows:

number of equivalent volumes:

The number of equivalent volumes represents the total number of normal sized volumes a library would contain if all such materials as microfilm, newspapers, films, and other information sources were in book form. The conversion formulas are in the appendix.

stack area:

This is a room or portion of a room used to provide shelving for books or library materials used by the staff and/or students on an individual basis.

open stack reading area:

This is an area that combines a study room and a stack.

process area:

This is the area that contains the card catalogs, circulation desk, bookbinding, microfilm processing, and audio-visual master control equipment.

study facilities service area:

This is the area devoted to closets, lockers, and coatrooms.

number of stations:

This is the total number of seats available to students for studying.

number of full time equivalent personnel:

This is the number of employees when two part time employees are counted as one full time employee.

(open stack reading area + study area)/number of stations:

This is a measure of the study space alloted to each station in the library. It quantizes the "spaciousness" of the library.

stack area/volumes and (stack + open stack area)/volumes:

These two figures are measurements of storage efficiency in terms of space allotted per volume.

number of stations/student:

This relates the supply of library study space to the demand as measured by the size of the student body.

full time equivalent personnel/student:

This relates the supply of library services as measured by employment to student body demand.

full time equivalent personnel/1000 volumes:

This measures employment figures against the size of the library.

(processing + facilities area)/volume:

This compares the library service, clerical, and maintenance area to the number of volumes stored.

(processing + facilities area)/(study + stack + open stack area):

This measures the area devoted to services and maintenance against the area devoted to storage and study.

Many of these figures, particularly the last three, can be considered measurements of efficiency. In using them in this way, however, it is important to compensate for the effect of different levels of maintenance and service. The difference in service space and employee requirements can vary considerably from library to library: some do not circulate books, maintain fragile or rare book collections that require special maintenance, provide reprint supply services, or work under other restrictions and special requirements. In fact, these figures can be turned around and used as measurements of service levels if efficiency variations are compensated for or controlled.

Using the Study

There are three degrees of freedom involved in selecting relevant data from the study. The first is the level from which the data was derived: a school, a type of school, or all schools in the state. Another is the category for which the data is representative: the type of classroom, the level of instruction, and the department subject matter. The final choice is between the actual contents of the different data: enrollment, classroom occupancy, or average station size.

The subject of an application determines what type of questions the data should answer. The descriptions of the different derived data (pp. 14-19) should aid in this decision. Quite often what appears to be irrelevant data at the beginning of a study becomes important as research progresses, particularly in looking for causes and side effects to some particular effect or parameter. Care should be exercised in using the data so as not to attribute too much value to one parameter. For example, the "average area per station," though in many ways a good measurement of efficiency in space utilization, fails to take into account many details that are crucial in evaluating use. The requirements for a "station" in a biology

laboratory, a language laboratory, a seminar room, and a lecture hall are all quite different. The categories are useful in separating out some of these variables, but even then this parameter cannot be used as an absolute measurement of efficiency. Other elements need to be considered: construction and land costs, maintenance costs, and the quality of the education received in the different sized stations.

The categories are very useful in separating out extraneous variables such as the classroom types in the above example, and the levels of instruction and the departments serve this same variable separating function. Besides this the categories are useful in studying the utilization patterns of some very specific classes: the laboratories of graduate students on biology correspond to classroom type two and level of instruction three in the biological sciences matrices. Unfortunately, this separation cannot be complete. Within each classroom type there are significant differences: type one contains both lecture halls and small classrooms; type two includes small rehearsal halls and large chemistry laboratories; type four rooms can be a small room with a computer console or a large room filled with individual listening booths. These subcategories can be separated from each other by using the detailed room by room listings in the first three volumes of the Space Utilization Study together with the Facilities Inventory; each

study uses identical room numbers so room descriptions in the second can be matched easily with rooms in each matrix of the first. In this way numerous subcategories can be designed when needed for any specific application.

In using the categories it is also important to remember the essential subjectivity of the data sources, especially in deciding between classroom types. The decision as to whether a classroom was type one or type two often involved arbitrary decisions made differently at different schools. Usually the effect of this decision was minimal, but for some larger institutions the results are affected to a noticeable extent. This effect can also be minimized when necessary by using the facilities inventory and the detailed listings in volumes I-III.

More than one level of derivation will be needed in most studies: the state figures give a standard basis for the comparison of different schools, while the school figures indicate the degree of variation and the validity of the state averages as representative "normal" figures for all the schools. Having selected the proper levels, categories, and content of the derived data, the outline of the report can be used to locate the appropriate matrixes in the six volumes.

Some Examples of Applications

The following examples are not the limits of applications for the study. They indicate only some of the questions the Space Utilization Study provokes and were intended as an aid in familiarizing analysts with the computer output itself.

1. How many rooms are used by institutions of higher education in Massachusetts? How does this vary from school to school?

The relevant data are the "average number of rooms used per week." In this example we shall limit ourselves to the category of classroom type one for all departments and levels of instruction. Beginning our investigation at the statewide level, the first relevant matrix is the "State Totals by Classroom Type" in volume VI; a slightly different matrix, "State Totals by Classroom Type and College Type -- Grand Totals," gives the same information (duplicated here as Table I). This matrix gives 40 as the state "average number of rooms used per week." If we refer to a preceding matrix, the "State Totals by Classroom Type and College Type" (Table II), we see that this is the average of a spread of figures from eleven to one hundred fifty three, each figure corresponding to a college type. These figures were derived from the figures for each individual school, and it is to these figures that we now turn. Using the school reports by classroom type (volume V), we can get the number of rooms used per week and with this information construct a distribution curve showing the number of schools using a given number of type 1 classrooms each week (figure 1). This curve shows one school with only one classroom, a large group of schools with between ten and fifteen classes, a supplementary peak at thirty six

STATE TOTAL REPORT

TOTAL FOR CLASSROOM TYPE 1

Table I

GRAND TOTALS	ALL SCHOOLS
NUMBER OF SCHOOLS	79
ENROLLMENT	
FULL TIME UNDERGRADUATE	144,206
FULL TIME GRADUATE	25,464
PART TIME UNDERGRADUATE	40,595
PART TIME GRADUATE	20,721
FULL TIME EQUIVALENT	190,089
AVERAGE NO. ROOMS USED/WEEK	40
AVERAGE NO. STATIONS/ROOM	56.0
AVERAGE ASSIGNABLE AREA/ROOM	827
AVERAGE WEEKLY ROOM-HOURS	1,008
AVERAGE WEEKLY STUDENT-HOURS	28,656
AVERAGE WKLY STUDENT-HOURS/STD	12.6
AVERAGE STATION OCCUPACY (PC)	50.7
AVERAGE AREA/STATION	14.7
AVERAGE TOTAL NO. OF STATIONS	2,276

STATE TOTAL REPORT

TOTAL FOR CLASSROOM TYPE 1

Table II

	I. TWO YEAR PUBLIC	I. TWO YEAR PRIVATE	II. FOUR YEAR (NG) PUBLIC	II. FOUR YEAR (NG) PRIVATE	III. FOUR YEAR PUBLIC	III. FOUR YEAR PRIVATE	UNIVERSITY PUBLIC	UNIVERSITY PRIVATE	OTHER PRIVATE
NUMBER OF SCHOOLS	13	14	3	12	7	16	2	9	3
ENROLLMENT									
FULL TIME UNDERGRADUATE	16,946	8,338	4,440	9,797	16,621	18,984	17,746	48,968	2,366
FULL TIME GRADUATE	0	0	0	0	1,281	869	2,193	20,664	457
PART TIME UNDERGRADUATE	6,496	1,988	74	3,292	2,649	2,978	3,737	18,401	980
PART TIME GRADUATE	0	0	0	0	6,018	2,144	1,767	10,734	58
FULL TIME EQUIVALENT	19,109	8,998	4,464	10,890	20,791	21,556	21,773	79,340	3,168
AVERAGE NO. ROOMS USED/WEEK	19	16	28	21	39	33	153	136	11
AVERAGE NO. STATIONS/ROOM	43.2	50.3	37.1	52.7	61.5	50.4	58.7	61.4	87.6
AVERAGE ASSIGNABLE AREA/ROOM	786	729	652	806	1,024	745	849	852	1,015
AVERAGE WEEKLY ROOM-HOURS	619	313	752	452	1,198	714	4,310	3,349	325
AVERAGE WEEKLY STUDENT-HOURS	16,793	7,768	20,300	12,813	34,779	16,793	140,182	99,306	11,951
AVERAGE WKLY STUDENT-HOURS/STD	10.8	12.0	13.6	13.8	12.8	12.7	13.5	12.8	9.7
AVERAGE STATION OCCUPACY (PC)	62.7	49.2	72.7	53.7	47.1	46.6	55.4	48.2	41.9
AVERAGE AREA/STATION	18.1	14.4	17.5	15.2	16.6	14.7	14.4	13.8	11.5
AVERAGE TOTAL NO. OF STATIONS	845	823	1,066	1,156	2,452	1,669	8,994	8,369	964

classrooms, and then a long tail with small clumps centered at sixty eight, one hundred forty, and two hundred fifty. The state average of forty falls at the trough at the end of the second peak; the result of this is that a conceptual "average school" with forty type one classrooms used per week would not correspond to a normal type of school with respect to the number of classrooms. In other words, on this curve the average does not reflect a "normal type" but rather a type of mathematical center of gravity for the entire distribution. The distribution curve shows that there is no single normal number of classrooms used per week near which most schools fall. The irregularity of the distribution suggests we treat the clumps on the curve as different types of schools, and that we search for parameters that cause or categories that explain this clumping. Identification of the schools shows that the first peak corresponds to a large number of junior colleges, the second peak to four year colleges, and the smaller supplementary peaks in the tail to the largest four year colleges and the universities. The average for each type of college (table II) corresponds closely to the "peak" for one group along the distribution curve -- except for the widely distributed universities. The shape of the curve suggests that we divide the institutions into three groups: a "small" group centered around sixty eight classrooms, a "medium" group at 145 classrooms, and a "big" group centered at 252, each group corresponding to one of the small clumps in the tail of the curve.

Examination of the universities of each group shows that they do have traits other than the number of classrooms that differentiate them. The number of classrooms corresponds directly with the size of the enrollment, and less obviously, with the number of students in each classroom. It was this distinct differentiation between universities of very different sizes that Clark Kerr referred to in coining the name "multiversity."

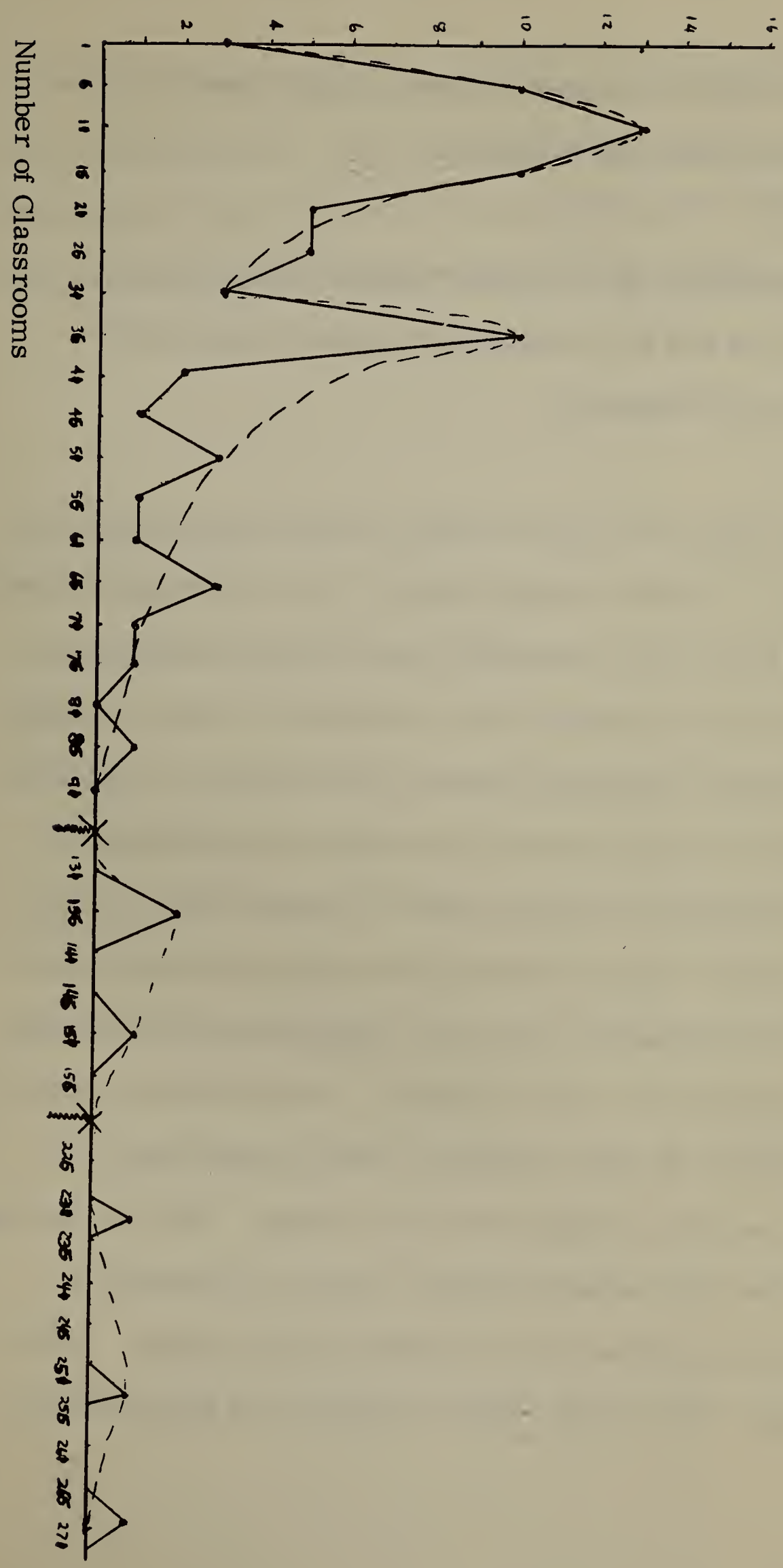
Number of Institutions
2
4
6
8
10
12
14
16
Number of Classrooms
1
6
11
16
21
26
31
36
41
46
51
56
61
66
71
76
81
86
91
96
101
106
111
116
121
126
131
136
141
146
151
156
161
166
171
176
181
186
191
196
201
206
211
216
221
226
231
236
241
246
251
256
261
266
271

FIGURE 1.

2. How many hours do students spend in class? How does this vary with different schools and categories?

The relevant data here are the "weekly student hours per student." Again, we will be considering this data for each level of derivation and for all categories.

Consider first the "State Average of Weekly Student Hours per Student" in table I. The average figure given, 12.6, corresponds closely to the maximum point of the distribution curve for this data (figure 2). This curve was derived in the same way as the curve for the preceding example, but it shows completely different characteristics: instead of being pathological, the curve has only one slightly skewed maximum. The average corresponds to a large number of schools and in a sense indicates the "normal" amount of time spent in type one classrooms by students. It is interesting that this curve, though far less erratic than figure I, also divides into clumps of schools. As can be seen in table II, many junior colleges are below average in weekly student hours per student, while most other colleges are above average. The state average weekly student hours per student provides a point of reference for placing the schools into these above and below average groups. In the preceding example, the average number of classes per school was not

as useful a reference point; irregularities in the distribution curve were used as dividing points instead. In both these examples, the individual school reports were referred to as a supplementary indication of the value of the averages as representations of the normal.

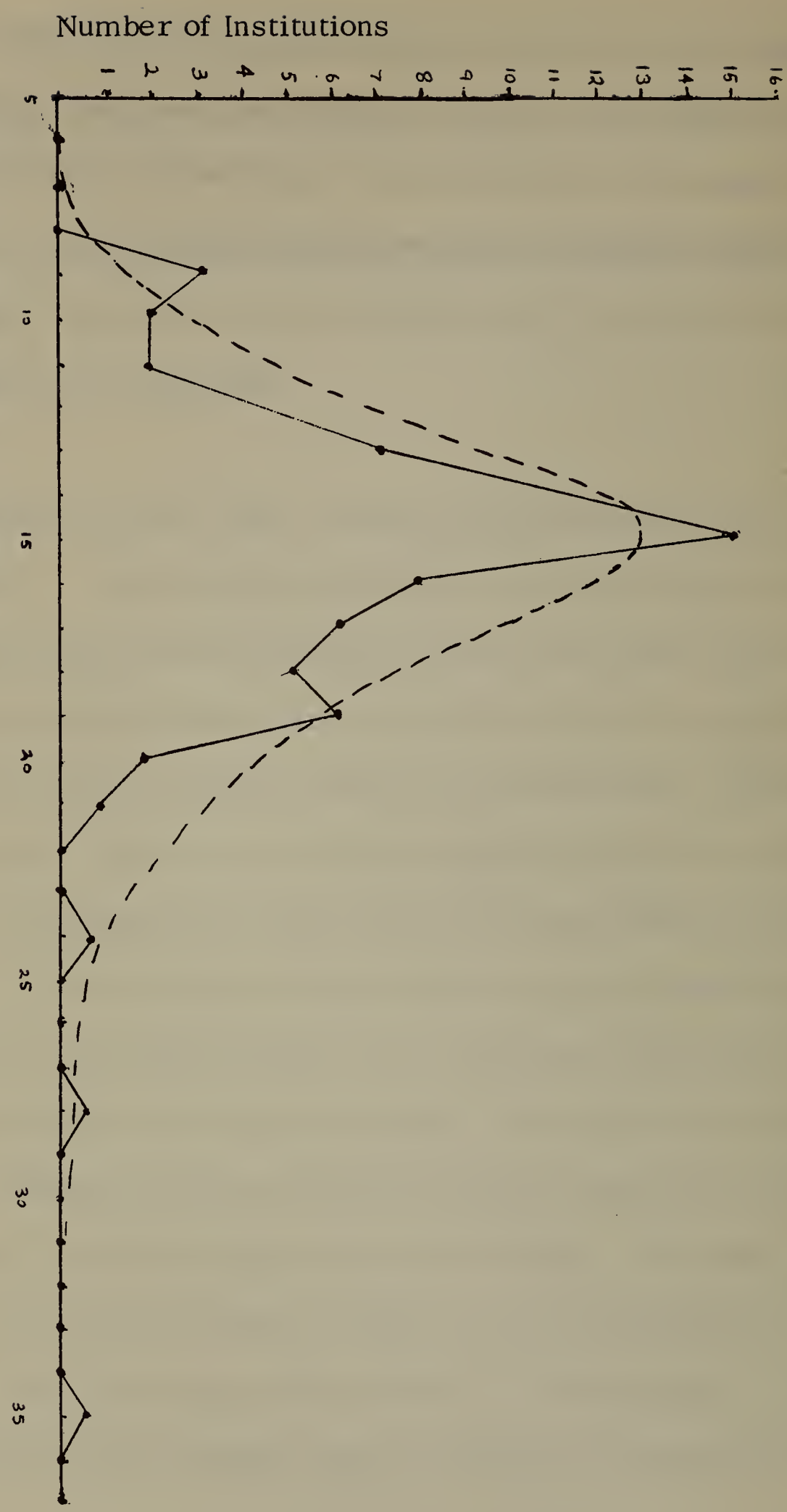
Number of Institutions
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
5
10
15
20
25
30
35
Number of Student Hours per Week

FIGURE 2.

3. What are the average station occupancies for different types of schools and classes? What are the causes of the differences in these figures?

In many instances a person primarily interested in a particular school will find it useful to refer to the state averages. Significantly large differences between the school figures and the state averages should provoke questions, and these questions may be answered by other parameters in the facilities inventory or the Space Utilization Study. Compare the "average station occupancy (pc)" figure in table I with the same figure in the School Totals report of volume V, the University of Massachusetts at Boston, (duplicated here as table III). A significant difference occurs which might be explained by related differences: the school's dependence on public funds, the small size of the classes, the small classrooms, and the lack of graduate students. Each of these possibilities could be investigated by comparing the figures for the University of Massachusetts at Boston with figures from schools which are comparable in all other parameters but these. Certain patterns emerge: publicly financed schools; schools with few graduate students, part time graduate students, and part time undergraduates; and schools with smaller classes all tend to have higher station occupancies than their counterparts. All of these patterns can be observed in the aggregate in table III.

SCHOOL NUMBER 880 SCHOOL NAME UNIVERSITY OF MASSACHUSETTS-BOSTON

SCHOOL TOTALS

Table III

ROOMS USED PER WEEK	84
AVERAGE STATIONS PER ROOM	36.3
AVERAGE ASSIGNABLE AREA/ROOM	700.1
WEEKLY ROOM-HOURS	2,115
WEEKLY STUDENT-HOURS	52,681
AVERAGE NUMBER STUDENTS/CLASS	24.9
AVERAGE STATION OCCUPANCY	68.5%
AVERAGE AREA PER STATION	19.2
FULL TIME GRADUATE ENROLLMENT	0
FULL TIME UNDERGRADUATE ENROLLMENT	3,523
PART TIME GRADUATE ENROLLMENT	0
PART TIME UNDERGRADUATE ENROLLMENT	74
FULL TIME EQUIVALENT ENROLLMENT	3,547
UNDERGRADUATE WSH/UNDERGRADUATE FTE	14.8

The question that immediately arises is one of causality: what degree of dependence exists between the above three factors? Do the schools that have higher station occupancies have them because of these three factors, or are the three factors caused by pressures for a high station occupancy? Do the schools that have fewer part time graduate students have higher station occupancies because they tend to be publicly financed or tend to have smaller classes? Or is the reverse relation true? Or does some unnoticed factor cause the three observed factors and a higher station occupancy independently of one another? The problem of causality is very complex, but a careful attempt to isolate the factors from one another can help to identify the key relationships.

Together with the question of causality, an investigation of classroom occupancy would be concerned with the actual form of the interaction, how the causal factors make their effects. Possibilities for investigation might include:

1. Do graduate students and part time undergraduates make demands on the scheduling process that are more difficult to meet than undergraduate demands, thereby causing increasing inefficiencies in space utilization? What are these demands and how can they best be met?

2. Do smaller classes make scheduling easier and more efficient? To what degree does the efficiency gained by having smaller classrooms match the greater cost of building, staffing, and maintaining them?

3. Is the greater efficiency of public institutions caused by a lack of funds or better administration, or both? If it is due to a lack of funds, what effect does this have on the quality of education? If it is due to administrative methods, what are the methods that are used?

4. What is the trade-off between educational quality and scheduling efficiency as measured by the classroom occupancy figures?

The answers to these and many other questions can be found with the help of the facilities inventory and the Space Utilization Study. But in asking them we have gone beyond the scope of this paper; both the tasks of asking the right questions and giving the right answers require a context for the data, a background knowledge of the particular school or schools being studies. These questions were meant as a guide to the type of questions the study provokes, not an indication of the answers.

4. What is the average area per station for different categories and schools?

In this example we will be paying particular attention to classroom type two, though all of the categories will be used. Examining first the "State Totals by Classroom Type and College Type" for classroom type 1 (table II), the most striking characteristic of the data for the "average area per station" is the larger size of the stations in the public institutions. The difference appears most striking in "State Totals by Classroom Type and College Type" for classroom type two (table IV). This shows, for example, that public, four year colleges with graduate students provide 33% more space per laboratory station than private schools.

These statistics become still more surprising when we consider the results of the Facilities Inventory Analysis for 1969, which showed a relative lack of space in the public institutions: "From the great discrepancy between academic NASF (Net Assignable Square Feet)/students in public and private institutions. . . we must conclude either that the private institutions have more academic area per student than they absolutely need, or that the public institutions need more facilities."[1] Despite a shortage, the public institutions

TOTAL FOR CLASSROOM TYPE 2

Table IV

	I. TWO YEAR PUBLIC	I. TWO YEAR PRIVATE	II. FOUR YEAR (NG) PUBLIC	II. FOUR YEAR (NG) PRIVATE	III. FOUR YEAR PUBLIC	III. FOUR YEAR PRIVATE	UNIVERSITY PUBLIC	UNIVERSITY PRIVATE	OTHER PRIVATE
NUMBER OF SCHOOLS	13	14	3	11	7	16	2	9	3
ENROLLMENT									
FULL TIME UNDERGRADUATE	16,946	8,338	4,440	9,797	16,621	18,984	17,746	48,968	2,366
FULL TIME GRADUATE	0	0	0	0	1,281	869	2,193	20,664	457
PART TIME UNDERGRADUATE	6,496	1,988	74	2,942	2,649	2,978	3,737	18,401	980
PART TIME GRADUATE	0	0	0	0	6,018	2,144	1,767	10,734	58
FULL TIME EQUIVALENT	19,109	8,998	4,464	10,774	20,791	21,586	21,773	79,340	3,168
AVERAGE NO. ROOMS USED/WEEK	13	9	13	9	20	17	94	36	21
AVERAGE NO. STATIONS/ROOM	26.4	34.0	25.4	26.9	28.5	27.3	25.3	27.9	49.4
AVERAGE ASSIGNABLE AREA/ROOM	1,030	1,029	1,090	903	1,262	896	1,154	1,172	1,614
AVERAGE WEEKLY ROOM-HOURS	262	137	201	119	353	259	1,322	670	468
AVERAGE WEEKLY STUDENT-HOURS	5,027	2,753	4,373	1,784	7,134	3,319	28,808	11,459	8,381
AVERAGE WKLY STUDENT-HOURS/STD	3.2	4.2	2.9	1.7	2.7	2.5	2.7	1.7	7.2
AVERAGE STATION OCCUPACY (PC)	72.6	58.9	85.5	55.4	70.8	46.8	86.0	61.2	36.2
AVERAGE AREA/STATION	38.9	30.2	42.9	33.5	43.9	32.8	45.5	41.9	32.6
AVERAGE TOTAL NO. OF STATIONS	344	330	347	262	591	484	2,393	1,021	1,070

allot more of their available space to each station than the private institutions, thus providing a smaller capacity for a given space. We will briefly put forward some possible reasons for this disparity.

1. The subject matter taught at the public and private institutions may differ in emphasis and thus affect the amount of space needed per station.

   In exploring the effect of subject matter emphasis, we should control some extraneous factors that affect space utilization: the level of instruction and the classroom type. We will consider only those schools without graduate students, and will examine only classroom type two -- which does not vary as much in size and capacity within a subject field as does classroom type one.

   The disparity in our matrixes is quite large for four year colleges without graduate students, 26%, and here the causes may be expected to stand out in sharp relief.

   To find the subject fields in each college where type two classrooms are used, we turn to volume IV -- the Individual Schools by General Departments, Classroom Type, and Level of Instruction. In each school matrix for classroom type two, we find three relevant pieces of data: the number of "rooms used per week," the average number of "stations per room," and the "average area per station." By multiplying the first two figures, we derive the average number of stations used per week for each subject in the school (table V).

   By showing the number of stations in each subject field for both public and private four year colleges, we can rank the general departments in each type of institution in order of the

TABLE V. Station Utilization by Four Year Colleges Without Graduate Students.

Private Colleges	Stations Used Per Week	Average Area Per Station
Anna Maria College		
life sciences	169	23.5
M. P. C. E. sciences	163	21.2
humanities	125	26.3
Bently College		
M. P. C. E. sciences	60	17.7
behavioral sciences	36	29.5
humanities	36	29.5
Berkshire College		
M. P. C. E. sciences	40	12.1
behavioral sciences	40	12.1
humanities	52	16.1
professions	52	16.1
Boston Architecture		
professions	518	40.1
life sciences	36	58.3
humanities	36	33.8
technical-vocational	53	27.7
Curry College		
life sciences	35	25.1
M. P. C. E. sciences	160	31.8
behavioral sciences	30	19.2
humanities	30	30.0
Our Lady of the Elms		
life sciences	94	34.0
M. P. C. E. sciences	114	37.0
humanities	146	27.8

Private Colleges	Stations Used Per Week	Average Area Per Station
Merrimac College		
life sciences	135	34.6
M. P. C. E. sciences	402	41.8
behavioral sciences	35	26.7
humanities	68	31.0
Nicols College		
life sciences	24	35.0
M. P. C. E. sciences	18	25.5
technical-vocational	35	25.1
Regis College		
life sciences	232	21.1
M. P. C. E. sciences	178	35.9
humanities	74	51.0
physical education	35	110.5
Stonehill		
life sciences	70	27.9
M. P. C. E. sciences	82	35.0
humanities	35	21.6

Public Colleges	Stations Used Per Week	Average Area Per Station
Mass. College of the Arts		
humanities	372	43.6
professions	37	40.6
technical-vocational	371	40.8
Mass. Maritime Academy		
M. P. C. E. sciences	17	92.6
University of Mass. at Boston		
life sciences	170	45.7
M. P. C. E. sciences	159	48.9
humanities	44	23.5

TABLE VI. General Departments Ranked by Number of Stations.

Private Institutions

Rank Number	General Department	Total Number of Stations Used per Week
1	Mathematics, Physics, Computer and Engineering Sciences	1,217
2	Life Sciences	795
3	Humanities	602
4	Professions	570
5	Behavioral Sciences	176
6	Technical-Vocational	88
7	Physical Education	35

Public Institutions

Rank Number	General Department	Total Number of Stations Used per Week
1	Humanities	416
2	Technical-Vocational	371
3	Mathematics, Physics, Computer and Engineering Sciences	176
4	Life Sciences	170
5	Professions	37

TABLE VII. General Departments Ranked in Order of Average Station Size

Rank Number	General Department	Average Station Size
1	Mathematics, Physical, Computer and Engineering Sciences	46.1
2	Technical-Vocational	39.5
3	Life Sciences	39.3
4	Physical Education and Military Sciences	36.5
5	Health Sciences	28.5
6	Humanities	26.6
7	Professions	25.9
8	Behavioral Sciences	24.8

emphasis given them as indicated by the number of stations they possess (table VI). As a basis of comparison between these two rankings, we turn to the State Totals by General Department, Classroom Type, and Level of Instruction (volume VI). For each general department, we take the "average area per station" for level of instruction one and classroom type two, and we then rank the general departments in order of this average station size (table VII). Comparison of the three rankings gives an ambiguous result. Though the top ranked department in the public institutions is quite low in space requirements, the next three departments are the three highest in their space requirements, and the only remaining public department has an insignificant number of stations. The private institutions have as their two top ranked departments the most highly rated departments in state average space requirements, the M. P. C. E. sciences and the life sciences; but the remaining departments of significant size, the humanities, professions, and behavioral sciences, are all rated at the bottom of the state wide rank list. This ambiguity is significant in showing that subject matter has at most a minimal correlation with the figures in table IV. Moreover, disparities in the area per station for the same departments in public and private schools show that emphasis on subject matter is not the cause of the overall difference in space allocation.

2. Are the state schools located in areas where costs are lower, thereby encouraging a more generous allocation of space? This possibility can be quickly dismissed as 2/3 of the public four year colleges without graduate students are actually located in Boston and Cambridge. The private institutions have a lower proportion located in the more expensive urban areas.

3. Another possibility is the age of the building. Have changes in building design in recent years allocated more space per station? If this is true, are the public schools newer and therefore more likely to have larger amounts of space?

   An investigation of this possibility would largely rest on the facilities inventory, which contains data on building age and condition.

Appendix

The Space Utilization Study Manual

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I. INTRODUCTION

The Space Utilization Study with its precursor, the Facilities Inventory Project, should together provide a significant and detailed overview of deployment and utilization of physical facilities of institutions of higher education within the Commonwealth of Massachusetts. The overall goal of this effort is to provide a data base to aid in the evaluation of the use of assignable space. This data base could potentially enhance the process of deciding how and where to accomodate a wide range of institutional activities in determining immediate and projected needs. We are entering a period in which demand for space in colleges is rapidly outstripping its availability; studies of this type become very timely in generating parameters of utilization efficiency and pointing out possible directions for future policies. Whereas we shall not presume to set artificial standards of evaluation based on such "efficiency parameters," it is hoped, rather, that the total result of the two studies will be to provide a powerful bas is for introspection for each of the participating institutions.

For the Utilization Study to be of value, it should be noted, participation in the Facilities Inventory Project is not prerequisite. The present study is meant to complement the first, but the stress is different. In the Facilities Inventory Project a detailed descriptional inventory was obtained, but the distribution of space among different functions within an institution was

coded by its predominate use and thereby described. In general, this is quite fair. A faculty office, for example, is not likely to undergo any significant functional alterations over a short period of time. Whereas a classroom similiarly remains a classroom, its function as a classroom varies from hour to hour and day to day, and as such becomes the object of a large portion of this Study.

Weekly scheduling data will be collected on a room-by-room basis from early morning until late evening among regularly scheduled facilities (classrooms, seminar rooms, class laboratories, etc.) to define the utilization characteristics of said facilities. In order that a standarized time be used by all participants, the schedule data inventory will be taken as of a "typical" week during the fall term of the 1969 to 1970 regular session.

In addition to this, data will be collected on the number, size, and types of libraries located on each campus. In the previous study we were unable to recognize libraries as entities. The present study, employing additional data, will do so.

There are three Forms in this study, two of which will be returned to us, the third a Worksheet for the use of the librarians. The forms of this Study reflect close parallels with the Facilities Inventory Project in the terminology and methodology employed. In particular, the Scheduled Facilities Form requires building number and room number assignments that should be identical with those used in the Facilities Inventory for effective correlation of the two studies (if applicable). Of the remaining

two forms, the Worksheet for Compiling Data for the Individual Libraries should be distributed to the respective librarians. After the Worksheets have been completed, they are to be returned to the person responsible for the Space Utilization Study, at which point the data should be transferred to the appropriate columns of the Library Form.

In the succeeding sections of this guide you will find detailed explanations of the Scheduled Facilities Form, the Worksheet, and the Library Form. Be sure to read the descriptions and accompanying definitions with care before proceeding. Please feel free to refer any questions to us.

II. SCHEDULED FACILITIES FORM

This form is the most important part of the study, for it will contain the majority of the information which we need to know. It also is the most difficult and time-consuming of the three forms. It is vital, therefore, that you fill it out with complete accuracy. Follow instructions carefully so that the keypunch operator will be able to transcribe your data quickly and without mistakes. One scheduled Facilities Form will be used for each scheduled classroom or laboratory.

The scheduled Facilities Form indicates how many students of what status, studying a particular subject, occupy a particular kind of room in a certain building at each half-hour interval of the day. It also tells the number of places or stations in the room and the total assignable area of that room. For purposes of correlation and tabulation, we have standardized certain items on this form, but the standardized categories are broad enough to encompass almost any real situation. Rooms are divided into four categories according to type, certain subjects are grouped together under one code number, and the classroom day is broken down into half-hourly segments. None but the last of these standard procedures should give trouble, and even the half-hourly divisions of time can be made to conform to the facts. In the description that follows,each item on this form will be explained in detail.

A. NUMBERED ITEMS:

1. CAMPUS NUMBER: Each school has been assigned a unique number. That number positively identifies the school; use it on this form, referring to the Facilities Inventory printout to verify it.

2. BUILDING NUMBER: The Facilities Inventory Project assigned a unique three-digit or less number to each building. That number still positively identifies the building; use it on this form, referring to the Facilities Inventory printout to verify it. If a building was not included in the Facilities Inventory, the officer responsible for completing the Space Utilization Study should assign unique numbers to each of the buildings concerned.

3. ROOM NUMBER: The Facilities Inventory assigned a unique five-digit or less number to each room in a building. (Letters and/or numbers may be used). That number still positively identifies the room; use it on this form, referring to the Facilities Inventory printout to verify it. (This number must be changed, however, if it is not unique within a given building). If a building was not included in the Facilities Inventory, room numbers must be supplied.

   Room numbers should be the same as those posted at the entries to rooms if they are non-repetitive within a given building; else, an artificial number must be assigned for this study. If the room is not numbered, simply supply a non-repetitive number. If a name is commonly used for the room rather than a number, assign a number to the room and use it along with the first letter of the room's name. Thus, "Farnsworth Room" might become "F11" (not " F - 11"). The crucial factor in numbering buildings and rooms within a building is that the numbers must be unique. Any duplication will invalidate the results of the Space Utilization Study.

4. ROOM CODE: Use one of the four following codes to describe each scheduled facility. If a scheduled facility should have more than one of the listed functions, use only the code for the predominant function and ignore the subordinate function.

   1 - CLASSROOM: Corresponds to code 110 in the Facilities Inventory Project
   Definition; A room used by classes which do not require special-purpose equipment for student use.

CLASSROOM (Continued)

Description: Included in this category are rooms generally referred to as lecture rooms, lecture-demonstration rooms, seminar rooms, and general purpose classrooms. A classroom may be furnished with special equipment appropriate to a specific area of study if this equipment does not render the room unsuitable for use by classes in other areas of study.

Limitations: This category does Not include conference rooms, auditoriums, or class laboratories. These are distinguished from the above categories by primary use.

2 - CLASS LABORATORY: Corresponds to code 210 in the Facilities Inventory Project

Definition: A room used by regularly scheduled classes which require special-purpose equipment for student participation, experimentation, observation, or practice in a field of study.

Description: A Class Laboratory is designed and/or furnished with specialized equipment to serve the needs of a particular area of study for group instruction in regularly scheduled classes. The design and/or equipment in such a room normally precludes its use for other areas of study. Included in this category are rooms generally referred to as teaching laboratories, instructional shops, typing laboratories, drafting rooms, band rooms, choral rooms, (group) music practice rooms, language laboratories, (group) studios, and similar specially designed and/or equipped rooms if they are used premarily for group instruction in regularly scheduled classes.

Limitations: This category does Not include laboratory rooms which serve as individual (or independent) study rooms. It does Not include laboratories used for group instruction which are informally or irregularly scheduled. This category does Not include rooms generally referred to as research laboratories. It does Not include gymnasiums, pools, drill halls, laboratory schools, teaching clinics, demonstration houses, and similar facilities.

3 - SPECIAL CLASS LABORATORY: Corresponds to code 220 in the Facilities Inventory Project.

Definition: A room used by informally (irregularly) scheduled classes which require special-purpose equipment for student participation, experimentation, observation, or practice in a field of study.

Description: A Special Class Laboratory is designed and/or furnished with specialized equipment to serve the needs of a particular area of study for group instruction in informally or irregularly scheduled classes. The design and/or equipment in such a room normally precludes its use for other areas. of study. Special Class Laboratories typically (but not necessarily or exclusively) include such rooms as language laboratories, (group) music practice rooms, (group) studios, etc.

Limitations: This category does Not include Class Laboratories, individual study rooms, or research laboratories, It does Not include gymnasiums, pools, drill halls, laboratory schools, teaching clinics, demonstration houses, and similar facilities.

4 - INDIVIDUAL STUDY LABORATORY: Corresponds to code 230 on the Facilities Inventory Project

Definition: A room especially equipped and/or designed for individual student experimentation,

INDIVIDUAL STUDY LABORATORY (Definition) (Continued)

observation, or practice in a particular field of study.

Description: Included in this category are music practice rooms, individual study laboratories, and similar rooms which serve a particular subject-matter area. Stations may be grouped (as in an individual study laboratory) or individualized (as in a music practice room).

Limitations: This category does Not include individual facilities which are intended for general study purposes.

5. NUMBER OF STATIONS: Write in the number of seats contained by the facility of the potential seating capacity when the room is full. (If the seating capacity has not changed since the Facilities Inventory data collection, take this number from the FIPS printout which you received).

6. ASSIGNABLE AREA: If the area has not changed, transcribe this figure from the Facilities Inventory printout. If a building or room was not included in the Facilities Inventory or if size alterations were made, take measurements according to Section IV of this Manual.

In addition to these numbered items, there are several unnumbered items appearing in the columns delineated by heavy or double green lines.

Reading from left to right:

B. UNNUMBERED ITEMS:

First Column: TIME PERIOD - the day is broken down into half hour periods, from 0600-0630 (6:00 A.M. - 6:30 A.M.) to 1030-1100 (10:30 P.M. - 11:00 P.M.) Simply indicate at which half-hour intervals scheduled activities take place by placing the class data to be described in the correct horizontal row.

Second Column: COMPUTER CODING OF TIME PERIOD - ignore this column. It is a programming code to indicate the day and time period of each specified activity.

Third Column: NUMBER OF STUDENTS: - As this is a four digit column, you must be careful to justify figures to the right, filling leading blanks with zeroes. If a class has nine students, write the digit "9" in the box of this column which is furthest to the right and fill in the remaining boxes with zeroes. "9" in the extreme left hand box will be read as "9,000" rather than "9".

Fourth Column: DEPARTMENTAL CODE - This three digit column indicates the department sponsoring a class scheduled to occupy a given room during a given time period. Each department code corresponds to one unique three digit number, as set forth below. After you have read this table of subject codes, you may find it helpful to list all the departments in your school with the corresponding headings we have provided.

If a school has a total of four departments or divisions (as recognized by the school itself), e.g., Biology, Mathematics, History and Humanities, a data sheet as follows might be completed.

Our Departments	SUS Number	SUS Description
1. Biology	210	Biological sciences
2. Mathematics	310	Mathematical sciences
3. History	420	Social sciences (lists "history")
4. Humanities	599	General Humanities

If this list is made carefully, it will save time and lessen the chance of error. (See Appendix for the Departmental Code listing and description).

Fifth Column: LEVEL OF INSTRUCTION - This one-digit column shows the student composition of the class. Of the following numbers, insert the one which most accurately reflects the make-up of the class:

1 - Composed predominantly of undergraduates (about 2/3 or more undergraduates).

2 - Composed of significant numbers of both graduates and undergraduates (1/3 to 2/3 undergraduate).

3 - Composed predominantly of graduates (about 2/3 or more graduates).

4 - Courses not considered supplemental to the regular college program, such as those within programs of continuing and adult education, extension college, or community orientation.

Sixth Column: TOTAL CONSECUTIVE 1/2-HOUR PERIODS - This column indicates the duration of a particular class in terms of half hour periods. When adding the number of half hour periods for each class, be sure to include the first half hour. If a class does not end exactly on the half hour but occupies more than 15 minutes of that half hour period, count the extra half hour. If it occupies less than 15 minutes of the half hour interval, do not count it. If it ends exactly at the 15 minute point, use your own judgment in deciding whether to count the half hour interval or not. (For clarification of counting half hour periods, see below).

There are two boxes in this column, so you can accomodate very long classes. For shorter ones, lasting from 1 to 9 half hour periods, justify the single digit to the right and place a zero in the left hand box.

EXAMPLES: A class which lasts from 10:00 A.M. to 11:20 A.M. occupies three half hour periods; enter it in this column as "03". A class which lasts from 11:00 A.M. to 4:40 P.M. occupies eleven half hour periods; enter it in this column as "11".

C. DETERMINING DURATION OF CLASS:

Some classes may neither begin nor end exactly on the half hour period. Apply the following criteria when assigning the bounds on the duration of a class.

a. If the scheduled activity involves more than fifteen of the thirty minutes in a particular time period, count the weekly room half hour within which the activity begins or ends.

b. If the scheduled activity lasts less than fifteen of the thirty minutes in a particular time period, do not count the weekly room half hour within which the activity begins or ends.

c. If the scheduled activity involves exactly fifteen of the thirty minutes in a particular time period, use your own judgment in assigning the weekly room half hour within which the activity begins or ends. Make this assignment in the manner most consistent with your educational program.

In such cases, take care to avoid counting weekly class half hours more than once. If a class meets from 1:45 P. M. to 3:15 P. M., you could count it for the 0130-0200, 0200-0230, and 0230-0300 periods; or you could count it for the 0200-0230, 0230-0300, and 0300-0330 periods. But be sure not to count it for both the 0130-0200 and 0300-0330 periods. The total consecutive half hour periods in either case will be 03.

D. FILLING OUT THE SCHEDULED FACILITIES FORM - SUMMARY

We have broken down the potentially confusing process of filling out this form into a number of specific steps. For more detailed instructions, refer to the preceding material.

1. Fill in data requested for items 1 through 6 at the top of the form. Refer to available FIPS printout for verification.

2. Determine when a class begins and locate the half hour period to the left of the chart which corresponds to the starting time of the class. (See preceding section C of this guide for instructions about determining half hour periods for classes which involve only portions of those periods). Follow the horizontal row designated by the relevant half hour period until you come to the vertical columns beneath the day of the week on which the first meeting of this class occurs.

3. In the column labelled NUMBER OF STUDENTS which appears beneath the day of the week on which the class begins, enter the number of students in the class, justifying to the right and adding appropriate zeros. Thus, a class with 36 students will read "0036" while a class with 3,600 students will read "3600". Write this number and all succeeding data relating to this particular class in the horizontal row designated by the half hour period in which the class begins. Finally, draw an arrow through the subsequent half-hour time periods that the class occupies to avoid confusion when assigning the first time period of the next following class.

4. Fill in the DEPARTMENTAL CODE, using the list we have provided .

5. Fill in the LEVEL OF INSTRUCTION, using the code we have provided.

6. In the same horizontal row, fill in the TOTAL CONSECUTIVE HALF HOUR PERIODS which the class occupies. (See sections B and C above). justify this total to the right, adding appropriate zeros, i.e., if a class lasts for five half hour periods, write "05".

7. Repeat steps 3 through 6 for each day of the week on which a particular class meets.

8. Example: For a history of science class given by the History Department (Code 420) which meets from 8:10 A.M. to 10:00 A.M. on Mondays and has 308 students of whom 240 are undergraduates, the

III. WORKSHEET FOR COMPILING DATA FOR INDIVIDUAL LIBRARIES AND LIBRARY FORM

The library personnel (presumably the head librarians) to whom you distribute the Worksheet should have no trouble filling it out accurately, for the relevant information appears on the back of the Worksheet. In most cases, the assignable area data required for the Worksheet is available from your Facilities Inventory output if the library itself does not have the data on file. The people who fill out the Worksheets should be informed of this data source. In cases where the library facilities have been altered or were never inventoried, the relevant areas will have to be measured via the techniques outlined in Section IV of this Manual.

When the Worksheets are complete, collect them, and transfer the data they contain to the Library Form. (The Worksheet is not forwarded to us - only the Library Form). Proceed as follows:

CAMPUS NUMBER: Insert your assigned campus number. If you participated in the Facilities Inventory Project, check the number you have written against the Facilities Inventory printout to make sure they are identical.

LIBRARY NAME: Justify the name of the library to the left of this space.

BUILDING NUMBER: Justify the building numbers to the right and fill in appropriate zeroes; i.e., if the building number is thirteen, write "013". If you participated in the Facilities Inventory Project, check building numbers against the Facilities Inventory Printout to make sure they are identical. If you did not participate in the Facilities Inventory Project, number buildings according to the instructions regarding the Building Number for the Scheduled Facilities Form.

EQUIVALENT VOLUMES, TOTAL STUDY AREA, TOTAL STACK AREA, TOTAL OPEN STACK READING AREA, TOTAL LIBRARY PROCESSING AREA, TOTAL STUDY FACILITIES SERVICE AREA, NUMBER OF STATIONS, NUMBER OF FTE PERSONNEL, LIBRARY CODE NUMBER.

Simple transfer these data from the bottom portions of the Worksheet to the appropriate places on the library Form. Justify all figures to the right, filling leading spaces with zeroes.

IV. ROOM MEASURING TECHNIQUES

To secure dimensions from drawings or by actual room measurements, it is suggested that the following procedure be followed after assigning a person(s) with the knowledge and skills to read and follow the instructions in the Manual, to read drawings, to take wall-to-wall measurements, and to compute totals. (This work can generally be performed by buildings and grounds supervisors and their assistants).

A. Assemble the following items:

1 set of floor plans for every building to be inventoried

Instructions

Pencils

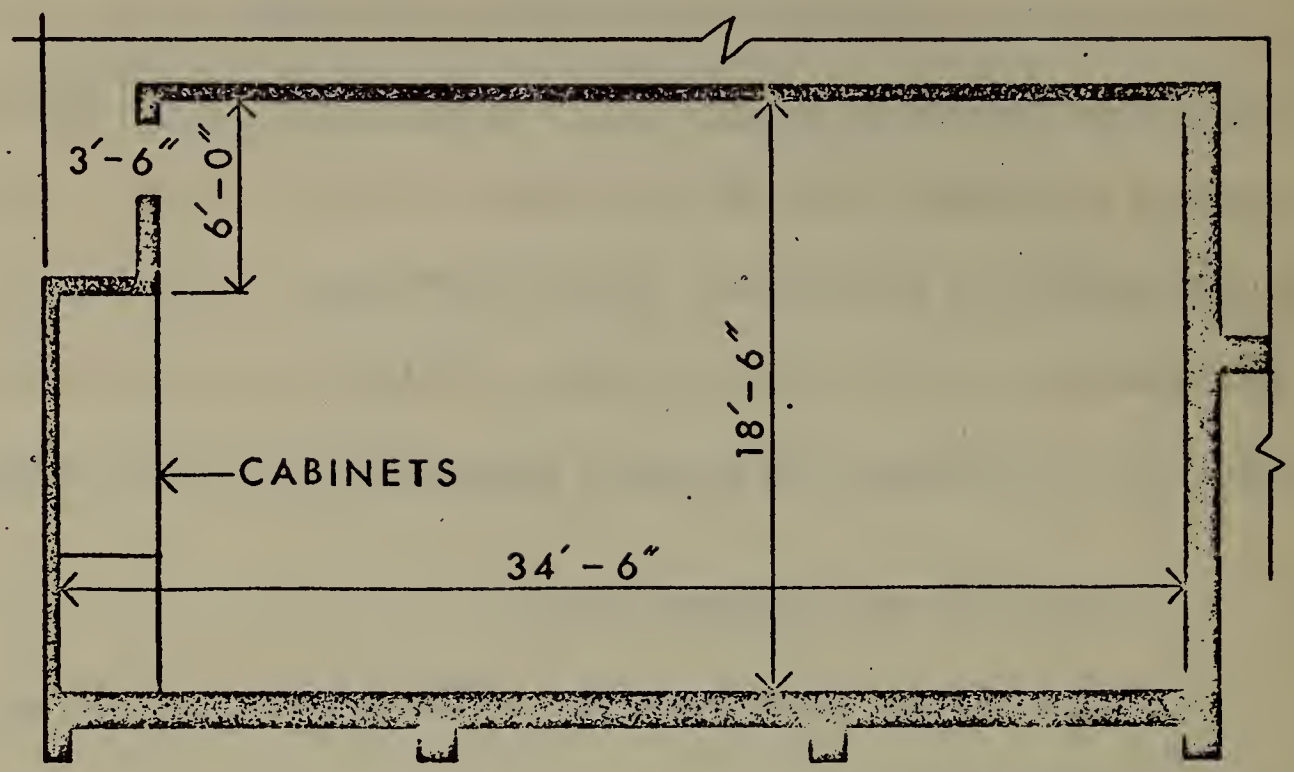
50-100' steel measuring tape

B. Use reliable scaled and dimensioned floor plans and blue prints to the extent they are available. The information requested for each scheduled facility should be entered in the appropriate place on each sheet to the extent that such information is available from the plans or from the accurate knowledge of the recording team.

C. A survey on the site should be made of all scheduled facilities for which measurement data could not be secured from the floor plans. Two persons with the items listed in A. above should secure data on all scheduled facilities for which the data were unobtainable from existing floor plans.

ROOM MEASURING TECHNIQUES (Continued)

D. Example of measuring individual rooms:



Net Assignable Area = length x width $\pm$ insets or offsets (inside dimensions)

Net Assignable Area = (34' - 6" x 18' - 6")-(6' - 0" x 3" - 6") = 617 s.f.

E. Alcoves, major offsets, irregularly shaped rooms, etc. often complicate the measuring process, In such cases it may prove helpful to draw a freehand sketch with necessary measurements on the scheduled facilities form so that the area can be verified or calculated at a later time.

(Note: All areas are to be reported to the nearest <u>whole</u> square foot - no fractions or decimals).

V. CONCLUDING REMARKS

Some final comments should be made with a view to easing the transition into and out of the current study.

We suggest again that you prepare in advance a listing of your recognized departments or divisions with our codes and descriptions that most closely correspond. (It may be necessary to combine departments under a single Space Utilization Study heading: e.g., Biology, Biochemistry, and Microbiology Departments under 210 - "Biological Sciences." A department more general than "Biological Sciences" might be classified 299- "General Life Sciences.") Please read all of the codes carefully before assigning numbers to your departments to be certain that the ones most appropriate have been selected. This list will serve as a complete description of your Departmental Codes, once formed, and further reference to the Appendix of this Manual will not be necessary. In addition, this list should aid in consistent assignment of Departmental Codes on the Scheduled Facilities Form.

The coding sheets are in a two-color format so that entries will be more readable for the keypunchers. Consequently, a dark pencil should be used. This will also allow for ready corection of transcription errors

Before sending us the Scheduled Facilities Forms and Library Forms, (you will not send the Worksheet), we strongly urge you to check over all the data that you are reporting to see that it is reasonable. We could not hope to check the data for errors ourselves for each of the participating

institutions before data processing; even if we were able, none but the most obvious errors would be apparent to us.

Be certain that all figures are right-justified; a class of nine students quickly becomes nine thousand if improperly recorded. Check that the Departmental Codes listed on the forms correspond exclusively to those of your list, and that the list has been properly compiled. Check that the lengths of all classes (in numbers of half hour periods) are reasonable. Check that the figures from the library Worksheet are reasonable and have been correctly transferred to the Library Form. Finally, putting the completed Scheduled Facilities Forms in order by room number within each building (checking that there is no duplication of room numbers within a building), staple the Forms for a given building together. Keep the Library Forms separate from the Scheduled Facilities Forms. Then forward the entire package to us.

It should be noted that the information derived from this study will very likely be of particular interest to each of the participating institutions. Whereas we shall do our best to insure a clean data file, there is no fool-proof or inexpensive process by which this can be accomplished. Therefore, it is in your best interest to take the extra hours required to examine for errors the final materials that you send to us; the data will be recorded on punched cards as we receive it.

We will be in contact with you on your progress during the course of this Study, but should you need more Forms or have particular questions beyond the scope of this Manual, please feel free to refer them to us at any time.

APPENDIX: DEPARTMENTAL CODE LISTING AND DESCRIPTION

NOTE: These codes are similar to the Organizational Unit and Subject Field Codes of the Facilities Inventory, except that for the Utilization Study we will be using a three-digit code, the result of dropping the leading digit (the Organizational Unit) of the Inventory Code.

GENERAL OR UNCLASSIFIED SUBJECT FIELDS:

110: General: Identifiable but broader than any category below.

120: Unclassified: Not identifiable - e.g., students with no declared major.

LIFE SCIENCES:

210: Biological Sciences: Animal sciences, plant sciences, biochemistry, biophysics, microbiology, etc., if not in an agricultural college or school, nor in a medical center, college, or school.

220: Agricultural Sciences: As in 210, but in an agricultural college or school, including forestry, but excluding agricultural economics, agricultural education, agricultural engineering, home economics, and veterinary medicine. (See also 232, 340, 420, 620, 640, and 705).

HEALTH SCIENCES: (Professional Level; see also 735).

231: Medicine: All basic medical sciences and clinical specialties

232: Veterinary Medicine

233: Dentistry

234: Nursing

235: Pharmacy

236: Public Health

238: Other Health Sciences: Osteopathy, podiatry, etc.

239: General Health Sciences

299: General Life Sciences

M. C. P. E. SCIENCES (MATHEMATICAL, COMPUTER, PHYSICAL, ENGINEERING)

310: Mathematical Sciences: Excludes computing science if organizationally separate.

320: Computer Sciences: Includes information and computing sciences.

330: Physical Sciences: Astronomy, including astrophysics, cosmology, radio astronomy, etc.; chemistry; environmental sciences, including atmospheric physics, earth sciences, meteorology, oceanography, paleontology, vulcanology, etc.; physics; etc..

340: Engineering Sciences: Aeronautical, astronautical, agricultural, ceramic, chemical, civil, construction, electrical, geological, geophysical, industrial, materials, mechanical, metallurgical, physical metallurgy, mineral, mining, mining geology, nuclear, petroleum, petroleum refining, sanitary, textile, transportation, and welding engineering; engineering mechanics, physics, and science; naval architecture and marine engineering; etc..

399: General M. C. P. E. Sciences

BEHAVIORAL SCIENCES:

410: Psychology

420: Social Sciences: Anthropology and archaeology; economics, including agricultural economics; geography, including physical

Social Sciences (Continued)

geography; history, including history of science, technology, etc.; political science and government; sociology; etc., including area studies, i.e., interdisciplinary studies of geographically defined areas.

499: General Behavioral Sciences

HUMANITIES:

510: Fine Arts; Art; drama, including cinematography, radio and television, and theatre arts; music, including musicology and performance; other fine arts, including dance. (See also 730).

520: Letters: English language and literature; foreign languages and literature; folklore, linguistics, philology, etc.; philosophy; religion, e.g., comparative religion (but also see 670); speech if not primarily dramatic arts; journalism if not a professional school (see also 690).

599: General Humanities

PROFESSIONS (PROFESSIONAL SCHOOLS NOT INCLUDED ABOVE):

610: Administrative Professions: Business administration; institutional administration, including hospital administration; public administration; etc., (See also 715).

620: Education: Includes agricultural education, business education, etc.

630: Environmental Design: Architecture, landscape architecture, urban and regional planning, etc..

640: Home Economics: Includes departments which are not in a professional school; includes departments of agricultural colleges.

650: Law

660: Social Work

670: Theology: Includes all instructional departments of divinity schools, so that data will be consistent with statutory exclusions from Federal-aid programs.

PROFESSIONS (Continued)

690: Other Professions: Criminology, journalism, library science, mortuary science, museum curatorship, etc.

699: General Professions

TECHNICAL-VOCATIONAL FIELDS:

705: Agricultural Technologies

710: Apparel Design or Fabrication Technologies

715: Business Technologies: Accounting, advertising, cosmetology, data processing, hotel, motel, and restaurant operation, insurance, physical distribution, retailing, sales, secretarial, and other business technologies.

720: Construction Technologies: Air conditioning and heating, cabinet making, carpentry, construction electricity, forest products, sheet metal, etc..

725: Engineering and Industrial Technologies: Architectural, chemical, civil, drafting and design, electrical, electronic, industrial, mechanical, and other engineering and industrial technologies.

730: Graphic Arts Technologies: Commercial art and advertising design, photography, printing, technical illustration, and other graphic-arts technology.

735: Health Technologies: Clinical laboratory technician, dental auxiliary (dental assistant, dental hygienist, dental technologist etc.), food-service superviser, inhalation therapist, vocational nurse, psychiatric aide, ward manager, x-ray technologist, etc.

750: Public Service Technologies: Fire protection, law enforcement, library assistant, teaching aide, urban-planning assistant, etc..

760: Transportation Technologies: Automotive, aviation, heavy truck, and other transportation technologies.

790: Other Technical-Vocational Fields: Other specific technical-vocational fields, not properly classified above.

TECHNICAL - VOCATIONAL FIELDS (Continued)

799: General Technical-Vocational Fields.

PHYSICAL EDUCATION AND MILITARY SCIENCES:

810: Physical Education: Includes health and recreation education as in "HPER" departments. Includes intramural athletic programs administered by the physical-education department, but excludes inter-collegiate athletics if organizationally separate.

820: Military Sciences: Air and Aerospace R. O. T. C., Army R. O. T. C., Navy R. O. T. C., and equivalent.